

Why You Should Read Accident Reports

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Disclaimers

- This talk represents my personal opinions only.
- I shall be speaking in broad generalities.
 - Assume that ‘engineers’, ‘investigators’, and similar collective terms are implicitly qualified by ‘some’, ‘many’, ‘most’, and similar terms, but never by ‘all’.
 - Do not assume that my citing of accidents involving certain airlines or companies means that those airlines or companies are less safe than those that are not cited.



Questions - 1

- Have you read at least one NTSB aviation accident report cover to cover?
- Have you read at least one NTSB accident report from another transportation mode cover to cover?
- Have you watched the webcast of an NTSB meeting (or attended one in person)?
- Do you know about the FAA's Aircraft Accidents Lessons Learned Course and website?

<http://lessons.workforceconnect.org/>



Questions - 2

- True or false: human error is the most frequently cited cause of major aviation accidents?
- What percentage of these accidents does it cause?
- True or false: human error is the most frequently cited cause of major accidents in the other transportation modes?



You should read accident reports because ...

you will be less likely to believe the myths that are commonly believed concerning accident investigation and reporting.



Reason 1: Myth Busting

- The myths come in two main varieties
 - Myths about specific accidents
 - ♦ AA 965
 - ♦ Mars Polar Lander
 - ♦ US 427
 - ♦ ...
 - Myths about investigation and reporting in general
 - ♦ Simplicity of causal determination
 - ♦ Tendency to blame individuals
 - ♦ ...



Myth Busting: Simplicity

Live!



Myth Busting: Blame

- Chris Johnson (U. of Glasgow) and I studied all major accident reports from NTSB (1996-2004)
 - Categorized probable causes and contributing factors from each
 - Computed percentages for each category
 - Generalized categories and recomputed percentages
- References: (see <http://tinyurl.com/cxayl>)
 - Holloway, C. Michael; Johnson, Chris W.: "On the Prevalence of Organizational Factors in Recent U.S. Transportation Accidents", to appear in *Proceedings of the 23rd International System Safety Conference*, 22-26 August 2005, San Diego, California.
 - Holloway, C. Michael; Johnson, Chris W.: "Distribution of Causes in Selected U.S. Aviation Accident Reports Between 1996 and 2003," *Proceedings of the 22nd International System Safety Conference*, 2-6 August 2004, Providence, Rhode Island.
 - Johnson, Chris W.; Holloway, C. Michael: "'Systemic Failures' and 'Human Error' in Canadian TSB Aviation Accident Reports between 1996 and 2002," *Proceedings of HCI in Aerospace 2004*, 29 September - 1 October 2004, Toulouse, France.



Example Causal Statement

The National Transportation Safety Board determines that the probable cause of the Korean Air flight 801 accident was the captain's failure to adequately brief and execute the non-precision approach and the first officer's and flight engineer's failure to effectively monitor and cross-check the captain's execution of the approach. Contributing to these failures were the captain's fatigue and Korean Air's inadequate flight crew training. Contributing to the accident was the Federal Aviation Administration's (FAA) intentional inhibition of the minimum safe altitude warning system (MSAW) at Guam and the agency's failure to adequately manage the system.



Extract Probable Causes

The National Transportation Safety Board determines that the probable cause of the Korean Air flight 801 accident was the **captain's failure to adequately brief and execute the non-precision approach and the first officer's and flight engineer's failure to effectively monitor and cross-check the captain's execution of the approach**. Contributing to these failures were the captain's fatigue and Korean Air's inadequate flight crew training. Contributing to the accident was the Federal Aviation Administration's (FAA) intentional inhibition of the minimum safe altitude warning system (MSAW) at Guam and the agency's failure to adequately manage the system.



Extract Contributing Factors

The National Transportation Safety Board determines that the probable cause of the Korean Air flight 801 accident was the **captain's failure to adequately brief and execute the non-precision approach** and the first officer's and flight engineer's failure to effectively monitor and cross-check the captain's execution of **the approach**. Contributing to these failures were **the captain's fatigue and Korean Air's inadequate flight crew training**. Contributing to the accident was **the Federal Aviation Administration's (FAA) intentional inhibition of the minimum safe altitude warning system (MSAW) at Guam and the agency's failure to adequately manage the system**.

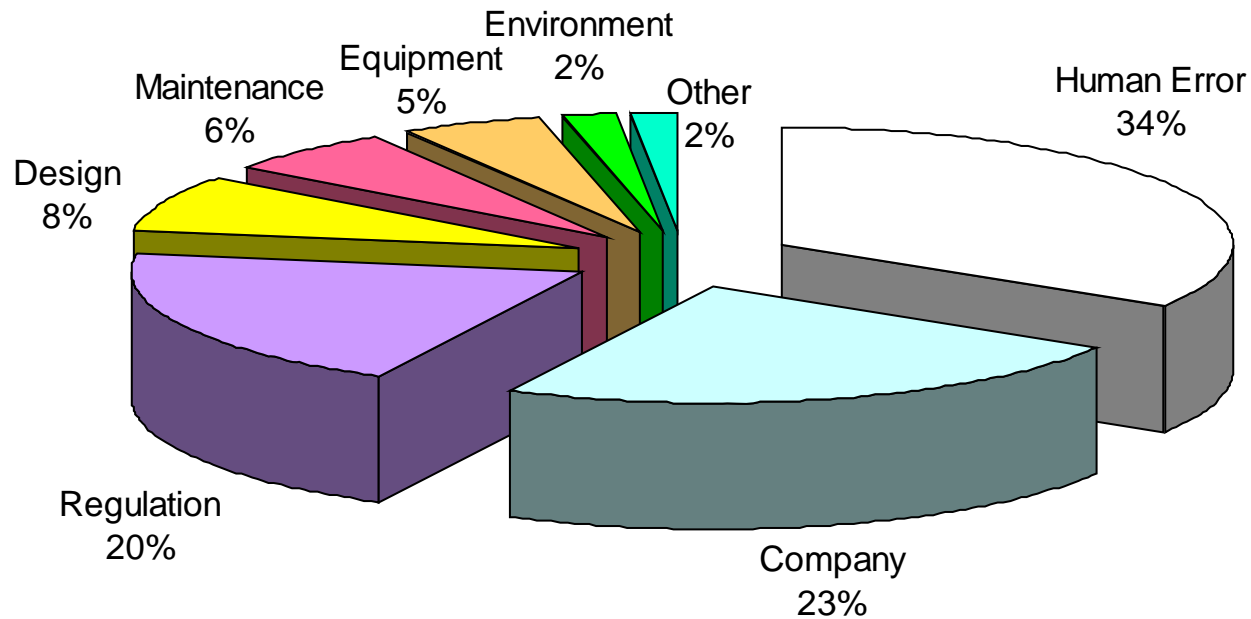


Format of Analysis (Example)

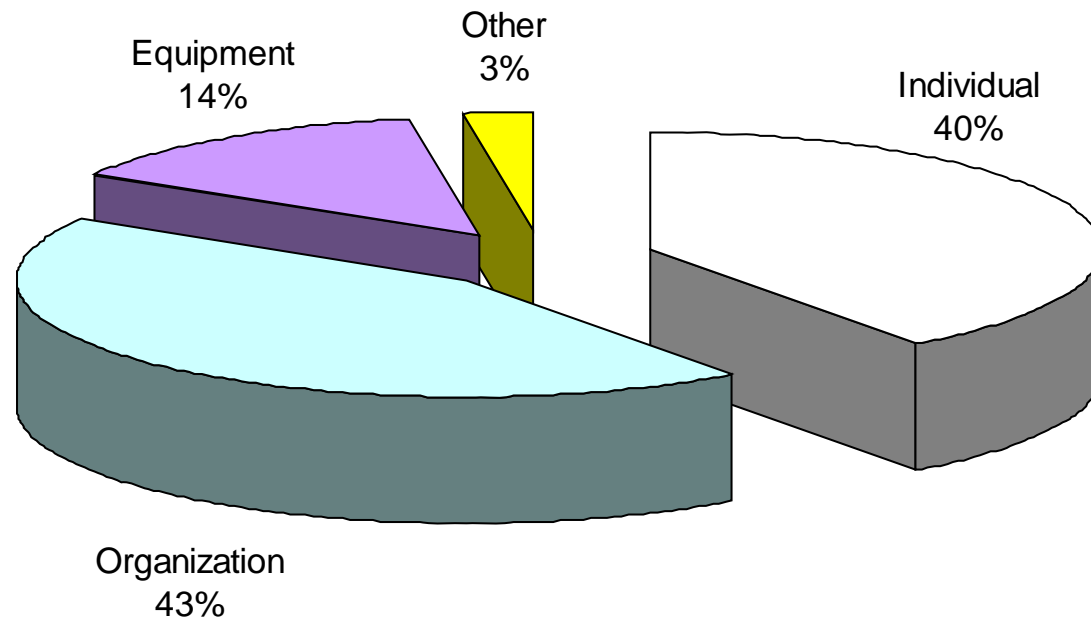
p	Company	the failure of ValuJet to properly oversee its contract maintenance program to ensure compliance with maintenance, maintenance training, and hazardous materials requirements and practices	AAR-97/06
p	Company	the failure of SabreTech to properly prepare, package, and identify unexpended chemical oxygen generators before presenting them to ValuJet for carriage	AAR-97/06
p	Regulation	the failure of the Federal Aviation Administration [FAA] to require smoke detection and fire suppression systems in class D cargo compartments	AAR-97/06
c	Company	ValuJet's failure to ensure that both ValuJet and contract maintenance facility employees were aware of the carrier's no-carry hazardous materials policy and had received appropriate hazardous materials training	AAR-97/06
c	Regulation	the failure of the FAA to adequately monitor ValuJet's heavy maintenance programs and responsibilities, including ValuJet's oversight of its contractors, and SabreTech's repair station certificate	AAR-97/06
c	Regulation	the failure of the FAA to adequately respond to prior chemical oxygen generator fires with programs to address the potential hazards	AAR-97/06



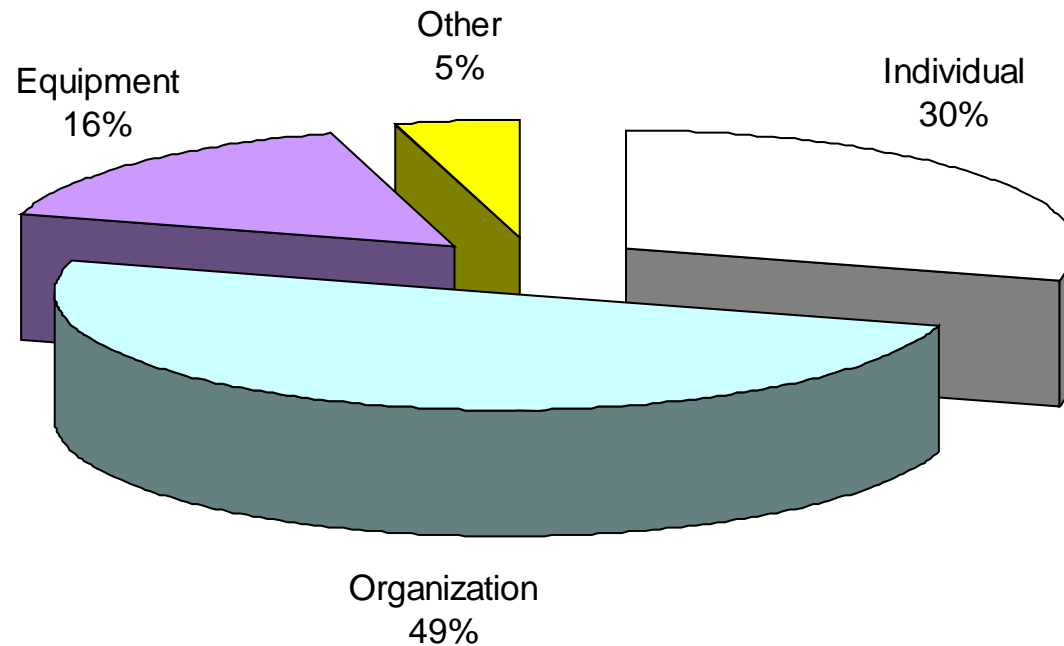
30 Aviation Accidents (1996-2004)



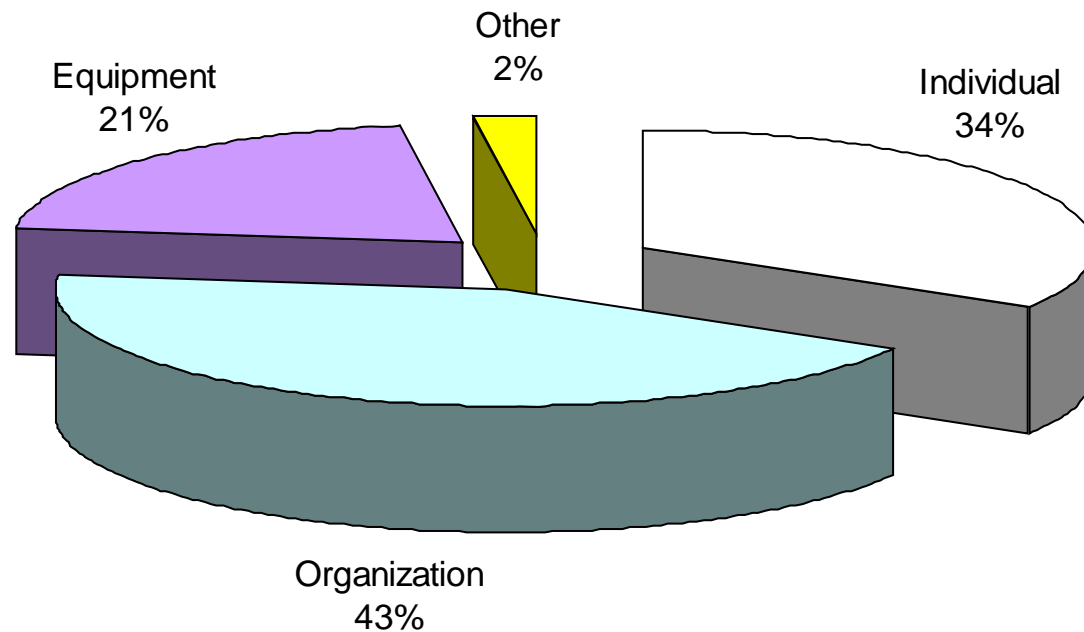
By Generalized Categories



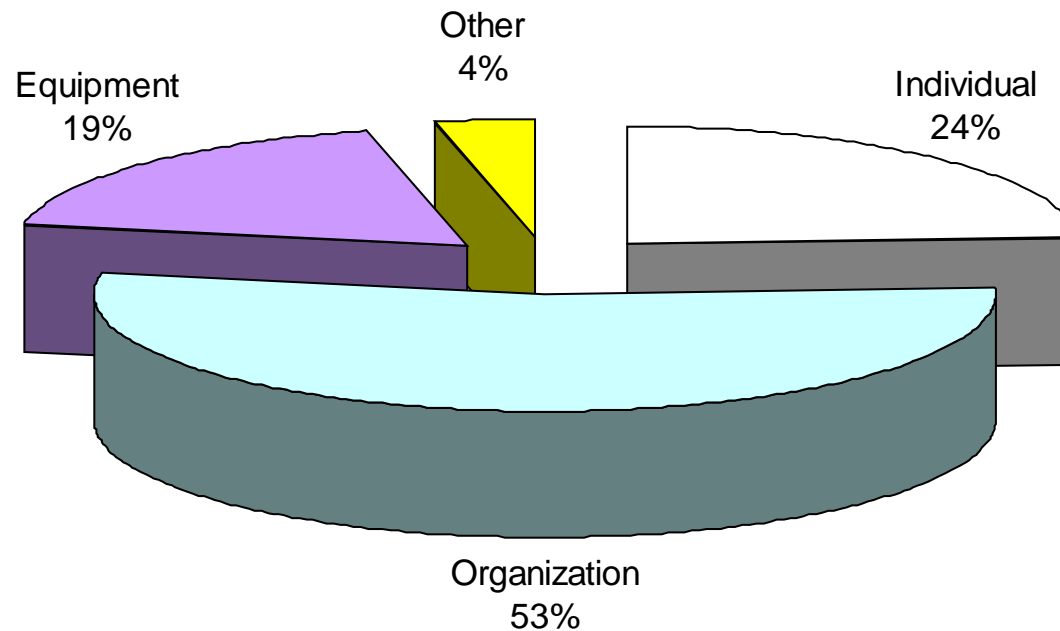
28 Railway Accidents (1996-2004)



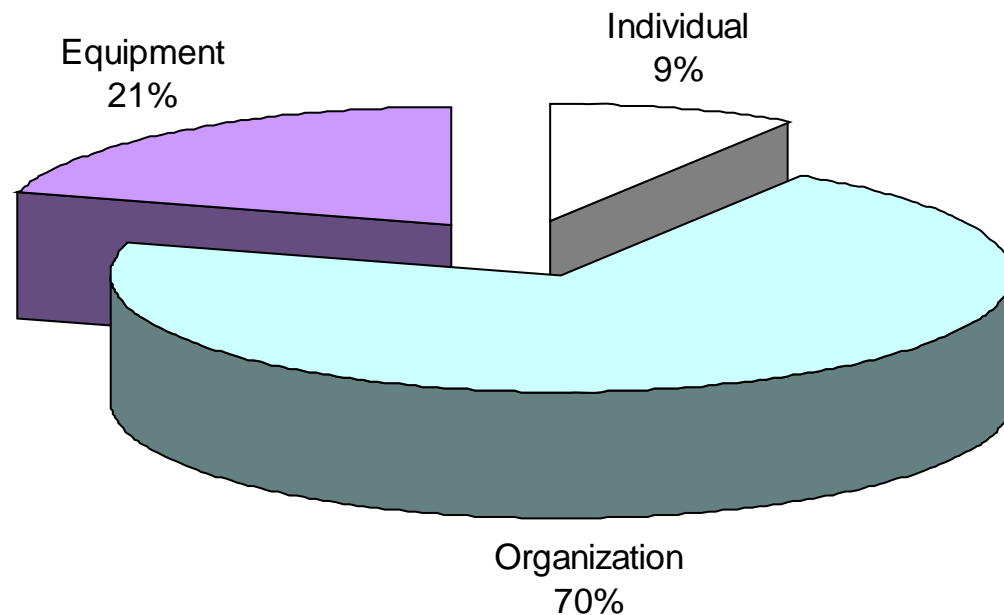
21 Highway Accidents (1996-2004)



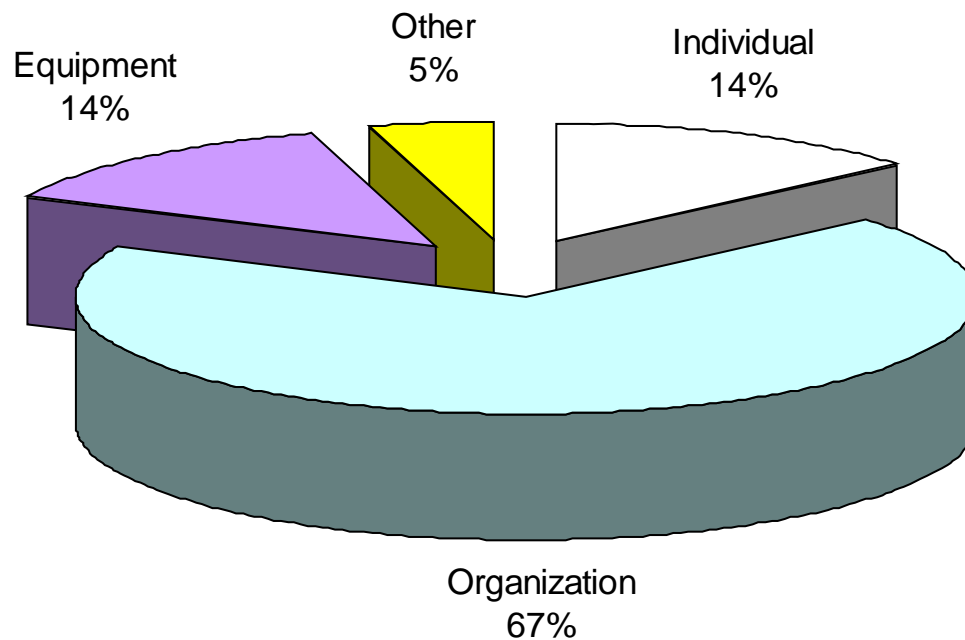
16 Marine Accidents (1996-2004)



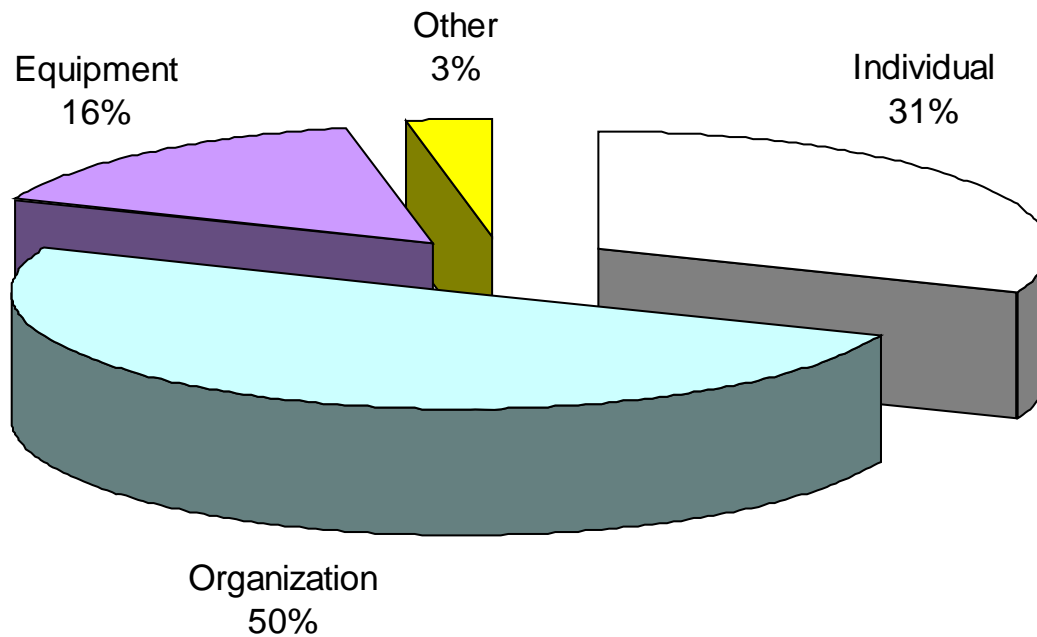
11 Pipeline Accidents (1996-2004)



8 HazMat Accidents (1996-2004)



Combined All-Modes (1996-2004)



Reason 1: Myth Busting

Questions?



You should read accident reports because ...

you will be more likely to have a realistic understanding
of the potential consequences of
“extremely improbable” occurrences.



Reason 2: Risk Understanding

- Engineers tend to think of safety in terms of a risk matrix, which combines *consequences* with *likelihood* (or *probability*).

CONSEQUENCES ↓	LIKELIHOOD →				
How Seriously Can it Hurt Someone?	How Likely is it to Hurt Someone?				
	VERY LIKELY	LIKELY	OCCASIONAL	UNLIKELY	VERY UNLIKELY
EXTREME	HIGH	HIGH	HIGH	MEDIUM	MEDIUM
MAJOR	HIGH	HIGH	MEDIUM	MEDIUM	LOW
MODERATE	HIGH	MEDIUM	MEDIUM	LOW	NEGLIGIBLE
MINOR	MEDIUM	MEDIUM	LOW	NEGLIGIBLE	NEGLIGIBLE



Reason 2: Risk Understanding

- Assertion: Normal people do not think this way; nor do engineers when not on the job.
 - The relative importance of *consequence* and *likelihood* is significantly different.
 - Example: Are these equal?
 - ♦ Occasional likelihood of broken bone
 - ♦ Unlikely likelihood of painful death
- Observation: The likelihood is always 'certain' (probability = 1) when an accident happens.



Reason 2: Risk Understanding

- Study of accident reports leads one to believe
 - We are pretty good at estimating consequences.
 - We are pretty bad at estimating likelihood.
 - ♦ To first approximation, we can say that accidents are almost always a result of incorrect estimates of the likelihood of one or more things.
- This belief leads me to the following conclusions:
 - Perhaps we tend to spend too much time playing around with probabilities.
 - Much of that time might be better spent thinking about consequences, particularly ways to eliminate or mitigate severe ones.



Reason 2: Risk Understanding

Questions?



You should read accident reports because ...

you will have more courage to refuse to compromise
system safety if you encounter
pressure to compromise.



Reason 3: Courage Enhancing

- Quite a few accidents have occurred as a result of causes that were anticipated by someone.
 - Inadequate warnings given; or
 - Warnings given, but dismissed for technical reasons (perhaps likelihood-based); or
 - Warnings given, but dismissed for other reasons.
- The more accident reports you read, the less likely you will be to
 - Fail to raise safety issues, or to continue to raise them even with initially rebuffed (engineers)
 - Fail to give strong consideration to safety concerns of competent engineers (managers)



Reason 3: Courage Enhancing

Questions?



You should read accident reports because ...

- You will be less likely to believe the myths that are commonly believed concerning accident investigation and reporting.
- You will be more likely to have a realistic understanding of the potential consequences of “extremely improbable” occurrences.
- You will have more courage to refuse to compromise system safety if you encounter pressure to compromise.



Where to Find Reports

- NTSB
 - All modes: <http://www.nts.gov/Publictn/publictn.htm>
 - Old aviation: <http://amelia.db.erau.edu/gen/ntsbaar.htm>
- Transportation Safety Board of Canada
 - <http://www.tsb.gc.ca/en/reports/index.asp>
- Australian Transport Safety Bureau
 - <http://www.atsb.gov.au/aviation/occurs/index.cfm>
- Air Accidents Investigation Branch (UK)
 - <http://www.aaib.dft.gov.uk/publications/index.cfm>

